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Chemical Weed Control in Crops, 1962

Cooperative Extension, South Dakota State University

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Cooperative Extension Service

SOUTH DAKOTA STATE COLLEGE

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Chemical Weed Control

Clean seed, proper seedbed preparation, good rotations, and sound soil management practices are prime requisites of controlling weeds in crops. They will eliminate many annual weeds and prevent infestation by most perennial weeds. Chemicals are valuable supplements to these practices. However, if we rely on 2,4-D or other chemicals, we at least partially neglect the standard practices. Consequently, weeds resistant to chemicals are allowed to spread.

Once weeds become established, special practices are needed to eliminate them. These practices include the use of special cultivation, competitive crops, and chemicals in addition to the old reliable practices already mentioned. One application of any one method seldom eliminates all perennial weeds. Even though they are eliminated, new weeds come from seeds in the soil. Some of these seeds remain viable for as long as 20 years and many years of diligent work are required to eradicate them.

Numerous tillage and chemical methods that will control weeds in crops are available. In fact, it is possible to eliminate some of the most persistant perennial noxious weeds while growing crops if the proper combination of crops, cultivation, and chemicals is used.

For detailed information, see publications that discuss control and elimination of specific noxious weeds or wild oats, weed control in crops, or pre-emergence weed control in row crops.

When using chemicals for weed control in crops (small grain especially), it is important to do it at the earliest possible time. This is important for two reasons: (1) the weeds are easier to kill when young (2) the weeds are competing with the crop for moisture and nutrients. If competition is not removed early they will cause yield reductions in the crop. This quite often happens by the time weeds are 6 inches tall.

In experimental work weed-free wheat yielded 45 bushels per acre. Wheat infested with mustard sprayed at the 4-leaf stage yielded 43.5 bushels per acre, sprayed at the 6-leaf stage yielded 39.8 bushels per acre, sprayed at flag leaf stage yielded 17.1 bushels per acre, the same as unsprayed wheat.

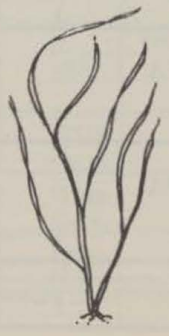
Crops and weeds get past the most desirable growth stages for spraying quite rapidly. At this time the weeds are not visible from a distance. Therefore, it is necessary to dismount from the car or tractor and walk through the field at early stages of development in order to know the extent of the weed problem as well as the stage of development of crops and weeds.

By **Kenneth R. Frost, Jr.**, Extension weed specialist,
and **Lyle A. Derscheid**, professor of agronomy

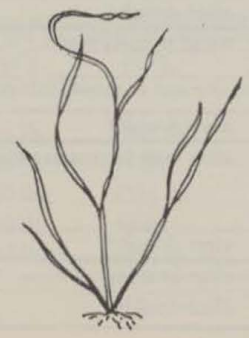
Stages of Growth in Field Crops

This plant is in the 5-leaf stage of growth.

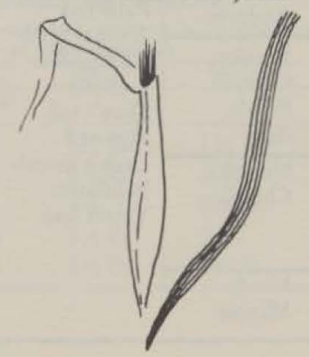
A plant with 4 leaves and 1 tiller. Also in 5-leaf stage.



A plant with 3 leaves and 2 tillers is in the 5-leaf stage.



Here's a close-up of the late boot stage. In the early boot stage of development, the stem is swollen between the second and third joint.



AMOUNT OF CHEMICAL FOR WEEDS

Different weeds require different amounts of chemical for their control. The same weed requires more chemical as it gets older. The amount of 2,4-D or MCPA required to control numerous weeds at different stages of growth is listed below.

¼ lb./A.	⅓ lb./A.	½ lb./A.	¾ lb./A.	1 lb./A. or more
Kochia 2-4 in.	Cocklebur 2-6 in.	Cinquefoil	Field bindweed	Bur ragweed
Lamb's quarters 4-6 in.	Kochia 4-8 in.	Cocklebur over 6 in.	Canada thistle	Blue lettuce
Mustard 4-6 in.	Lady's thumb 2-6 in.	Kochia over 8 in.	Perennial sowthistle	Buckbrush
Marsh elder 2-4 in.	Marsh elder over 4 in.	Gumweed 6-12 in.		Goldenrod
Ragweeds 2-4 in.	Morninglory, annual	Lady's thumb over 6 in.		Hoary cress
Pennycress	Ragweeds over 4 in.	Mare's tail		Leafy spurge
Pigweeds 2-4 in.	Russian thistle 2-4 in.	Puncture vine		Russian knapweed
	Sowthistle, annual 2-6 in.	Sowthistle, annual 6 in.		Sagebrush
	Sunflower 2-6 in.	Sunflower over 6 in.		Toadflax
	Peppergrass, annual	Velvet leaf over 6 in.		Wormwood
	Pennycress	Wild lettuce over 6 in.		
	Pigweeds over 4 in.			
	Velvet leaf 4-6 in.			
	Wild buckwheat 2 leaves			
	Wild lettuce 4-6 in.			

CONTROLLING WEEDS IN CROPS

The maximum pounds of 2,4-D and MCPA acid equivalent that can be tolerated by crops without risk of injuring the crop under most conditions is listed below. Use only enough to control the weed.

The pounds of dalapon or TCA, Avadex, barban, atrazine, amiben, or CDAA listed below is the amount of acid equivalent or active ingredient required for each acre of area treated to control the weed under the specified conditions. It is the amount required for each acre in the band for band applications.

Crop	Weeds	Safest time to spray (Most tolerant growth stages of crop)	Chemical	Rate lbs./A.	Remarks
Oat Varieties Mo-0-205 Garry	Lamb's quarters Marsh elder Annual morning glory Mustards Puncture vine Ragweed Cinquefoil Cocklebur Wild lettuce Pennycress Peppergrass False flax Annual vetch Annual sow thistle Mare's tail Pigweed Lady's thumb Sunflower Velvet leaf	3-leaf to dough	2,4-D ester	½	
			2,4-D or MCPA amine*	¾	
		after dough†	2,4-D	1	
Dupree Minhafer Burnett		5-leaf to dough	2,4-D ester	⅓	
			2,4-D or MCPA amine*	½	
		after dough†	2,4-D	1	
Ransom Waubay Newton Andrew		6-leaf to dough	2,4-D ester	⅓	These varieties may be injured by treatment at 6-leaf to dough stage but weed control should more than offset yield reductions.
			2,4-D or MCPA amine*	½	
		after dough†	2,4-D	1	
Brunker Clinton Bonda Ajax		6-leaf to early boot	2,4-D ester	⅓	
			2,4-D or MCPA amine*	½	
		after dough†	2,4-D	1	
Nemaha Cherokee		after boot begins to swell	2,4-D ester	⅓	
			2,4-D or MCPA amine*	½	
		after dough†	2,4-D	1	
Mindo Marion		after heading	2,4-D	⅓	
		after dough†	2,4-D	1	

CONTROLLING WEEDS IN CROPS (Continued)

Crop	Weeds	Safest time to spray (Most tolerant growth stages of crop)	Chemical	Rate lbs./A.	Remarks
Spring wheat and barley	Same as for oats	5-leaf to early boot	2,4-D ester 2,4-D amine	½ ¾	
		after dough†	2,4-D	1	
	Wild Oats	Post-emergence, 2 to 4-leaf stage	Barban (Trade name Carbyne)	⅓-⅜	Apply when wild oats are in 2-leaf stage. Use 50-60 lb. pressure.
Durum wheat and barley only	Wild Oats	Pre-emergence	(Trade name Avadex)	1¼	**For trial use only.** Work into soil with drag right after spraying.
Winter wheat and rye	Same as for oats	Spring, fully stooled to boot	2,4-D ester	⅓	Do not spray in fall.
			2,4-D amine	½	
		after dough†	2,4-D	1	
Flax	Same as for oats	Before weeds become 4 inches tall	2,4-D or MCPA amine*	¼	2,4-D may delay maturity from 3-7 days.
	Broadleaved	After bolls turn brown†	2,4-D	½-1	Germination of seed may be reduced if chemical is applied before bolls turn brown.
	Foxtails Barnyard grass	Before weeds are 2 inches tall	Dalapon	1	
			TCA	5	
	Wild Oats	Post-emergence	Barban (Trade name Carbyne)	¼-⅓	Apply when wild oats are in 2-leaf stage. Use 50-60 lbs. pressure.
		Pre-emergence	(Trade name Avadex)	1½	**For trial use only.** Work into soil with drag right after spraying.
Corn	Same as for oats	Before silking after several days of cool weather	2,4-D ester	¼-½	
			2,4-D amine	½-¾	
		After tasseling†	2,4-D	1	Use high-clearance sprayer with drop nozzles.
	Foxtails Barnyard grass Lamb's quarters Russian thistle	Pre-emergence	Atrazine	2-3	**For trial use only.** Must have ½-1 inch of rainfall within 2½ to 3 weeks after application. Band application will reduce cost. Carry-over will damage small grain seeded next year.
	Foxtails Barnyard grass	Pre-emergence	CDAA or CDAA-T (Trade-names Randox or Randox-T)	4	**For trial use only.** Must have ½ inch of rainfall within the first week after application.
Sorghum	Same as for oats	4-12 inches tall	2,4-D ester	⅓	Heights are determined by measuring from ground to where a new leaf is emerging.
			2,4-D amine	½	
		After heading†	2,4-D	1	Use high-clearance sprayer with drop nozzles.
	Foxtails Barnyard grass	Pre-emergence	CDAA (Trade name Randox)	4	**For trial use only.** As for corn.
Soybeans	Numerous broadleaved and grassy annuals	Pre-emergence	(Trade name Amiben)	3	**For trial use only.** Band applications will reduce cost.
			CDAA (Trade name Randox)	4	**For trial use only.** As for corn.

CONTROLLING WEEDS IN CROPS (Continued)

Crop	Weeds	Safest time to spray (Most tolerant growth stages of crop)	Chemical	Rate lbs./A.	Remarks
Sugar Beets	Numerous broadleaved and grassy annuals	Just before beets emerge	TCA	6	Must have rain or sprinkler irrigation soon after application.
		Before planting	(Trade name Tillam)	4	**For trial use only.** Work into soil with disk immediately after applying.
	Foxtails Barnyard grass	Post-emergence Before weeds are 2 inches tall	Dalapon	2	
		Post-emergence After weeds are 3 inches tall	Dalapon	4	Beets may be temporarily retarded and yield may be reduced.
	Wild oats	Post-emergence	Barban (Trade name Carbyne)	¾	Apply when wild oats are in 2-leaf stage. Use 50-60 lbs. pressure.
		Pre-emergence	(Trade name Avadex)	1½	**For trial use only.** Work into soil with drag right after spraying.
Birdsfoot trefoil Alfalfa Red Clover Alsike Clover Ladino Clover	Lamb's quarters Mustards Ragweeds Pigweeds Marsh elder	Seedlings when companion crop or weed canopy is 10-15" tall or established stands right after mowing	2,4-D amine MCPA amine*	¼	
Alfalfa Red or alsike clover Birdsfoot trefoil	Kochia Russian thistle Pennycress Lamb's quarters Pigweed Mustards Smartweeds	When legume is 2-4 inches tall	2,4-DB amine	½-1	Will kill tops or bindweed and Canada thistle. Forage from treated crops should not be fed to livestock.
			2,4-DB ester	½	
Alfalfa Sweet clover Birdsfoot trefoil	Foxtails Barnyard grass (not wild oats)	Seedlings alone or in flax, established stand after mowing	Dalapon	1	Forage from treated crops should not be fed to livestock.
			TCA	5	
Grasses Seedlings	Broadleaved	After 4-leaf stage	2,4-DB	½-1	Forage from crops treated with 2,4-DB should not be fed to livestock.
			2,4-D MCPA	¾	
Established stands	Broadleaved	Any time (except heading time for seed fields) best weed control in June	2,4-D MCPA 2,4,5-T	2	

*MCPA is not so apt to injure the crop; however, it is less effective as a weed killer. Use only if mustards or lamb's quarters are predominant weed species.

†Treatment at this stage will not remove weed competition early enough to improve crop yield; however, it may prevent weed seed production and will facilitate harvesting operations for small grain or flax.

USE CARE in following the directions listed above or on the manufacturer's label.

CALCULATING THE AMOUNT OF CHEMICAL TO APPLY PER ACRE

When applying chemicals in spray or granular form, it is essential to know exactly how much chemical is applied per acre. With sprays, it is also essential to mix water and chemicals in the right proportions. If this is not done, there is danger of injuring the crop with too much chemical or getting poor weed control with too little chemical. Therefore, the sprayer or granular applicator must be calibrated carefully and the chemical must be measured carefully for sprays.

The calculations are the same for band applications as for over-all (broadcast) treatments.

SPRAYER CALIBRATION (Over-all or Band)

Step 1. Select an area for a test run that is similar to the field to be treated. Accurately measure a distance of one-eight mile or 660 feet.

Step 2. Place the sprayer on level ground and fill the tank with water. It is best to fill it to the brim.

Step 3. Spray the test run, using the same gear and throttle setting on the tractor that will be used when spraying—usually 3 to 5 miles per hour. Also use the same spray pressure that will be used when spraying —somewhere between 30 and 50 pounds.

Step 4. Return the sprayer to the original filling position, on level ground, and measure the amount of water required to refill the tank to the brim.

Step 5. Multiply "66" times the amount of water required to fill the sprayer. Divide this answer by the width (feet) of the spray swath. This may be the width of swath from a regular field sprayer or may be total of several bands (4 x 14″=56″ or 4⅔′) or (6 x 7″=42″ or 3½′). This gives the number of gallons applied per acre.

Step 6. Determine the number of acres that can be sprayed with one sprayer tankful of spray. Divide the number of gallons in the tank by the number of gallons applied per acre.

Measurement of Chemical for Sprays

Step 7. Determine the amount of chemical needed per acre by checking in the circular to see how much chemical is needed to kill the weed in question and also check to see if the crop will tolerate this amount.

Step 8. Use table 1 to determine the number of quarts or pints of liquid required to spray an acre, or use table 2 to determine the pounds of dry material needed to spray an acre.

Step 9. Calculate the number of pints or pounds needed in the sprayer. Multiply the acres that can be sprayed with one tankful of spray by the number of pints or pounds required per acre.

Table 1. Conversion of Pounds to Pints or Quarts for Liquid Formulations

If you wish to apply this many pounds per acre	Your chemical contains this much acid equivalent or active ingredient per gallon						
	1.00	2.00	2.64 or 2.68	3.00	3.34 or 3.40	4.00	6.00
	Apply this amount on each acre						
⅛	1 pt.	½ pt.	⅜ pt.	⅓ pt.	3/10 pt.	¼ pt.	⅙ pt.
¼	1 qt.	1 pt.	¾ pt.	⅔ pt.	⅗ pt.	½ pt.	⅓ pt.
⅓	1⅓ qt.	1⅓ pt.	1 pt.	8/9 pt.	7/9 pt.	⅔ pt.	4/9 pt.
½	2 qt.	1 qt.	¾ qt.	⅔ qt.	1⅕ pt.	1 pt.	⅔ pt.
¾	3 qt.	1½ qt.	11/7 qt.	1 qt.	9/10 qt.	1½ pt.	1 pt.
1	1 gal.	2 qt.	1½ qt.	1⅓ qt.	1⅕ qt.	1 qt.	1⅓ pt.
1½	1½ gal.	3 qt.	2¼ qt.	2 qt.	1⅘ qt.	1½ qt.	2 pt.
2	2 gal.	1 gal.	3 qt.	2⅔ qt.	2⅖ qt.	2 qt.	2⅔ pt.

Table 2. Conversion of Pounds Active Ingredient to Pounds of Product for Powders and Granules

If you wish to apply this many pounds per acre	Your chemical contains this percentage of acid equivalent or active ingredient						
	4%	8%	10%	11.7%	20%	75%*	80%†
	Apply this amount on each acre treated						
1	25 lb.	12½ lb.	10 lb.	8½ lb.	5	1⅓ lb.	1¼ lb.
2	50 lb.	25 lb.	20 lb.	17 lb.	10	2⅔ lb.	2½ lb.
3	75 lb.	37½ lb.	30 lb.	25½ lb.	15	4 lb.	3¾ lb.
4	100 lb.	50 lb.	40 lb.	34 lb.	20	5⅓ lb.	5 lb.
5	125 lb.	62½ lb.	50 lb.	42½ lb.	25	6⅔ lb.	6¼ lb.

*85% sodium salt of dalapon. †90% sodium salt of TCA.

GRANULAR APPLICATOR CALIBRATION

Step 1. Use table 2 to determine the number of pounds of granular material required to give the number of pounds of active ingredient desired. For example, 20 pounds of atrazine granules containing 10% active ingredient contain 2 pounds of atrazine.

Step 2. Consult applicators manufacturer's rate chart to determine the approximate setting required for the number of pounds of granules to be applied (20 pounds in step 1). Adjust setting on each hopper.

Step 3. Select an area for a test run that is similar to the field to be treated. Accurately measure a distance of one-eighth mile or 660 feet.

Step 4. Fill hoppers and attach a container (sack, pail, etc.) to each hopper for catching granules separately from each hopper.

Step 5. Put machine in gear and drive the test run, driving at the same speed that will be used when applying the chemical.

Step 6. Multiply "66" times the number of pounds collected from each hopper separately. Divide each answer by the total width (feet) treated by each hopper (2 x 14″=28″ or 2⅓′ feet for 2-row bands). This gives the pounds of granular material applied per acre. If this is not the desired amount (20 pounds in step 1), readjust machine and repeat entire procedure until desired amount is obtained.

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